AMENDED CLAIMS

[received by the International Bureau on 29 September 1998 (29.09.98); original claims 1-30 replaced by new claims 1-26 (5 pages)]

1. A method for damping vibration induced by rolls forming a nip in a paper machine or in a paper finishing device by means of a dynamic damper which comprises an additional weight ~~suspended~~ from a vibrating system by means of a spring, ~~whereby in the method~~ the spring constant of the spring (3,3b) of the dynamic damper and/or the mass (4a, 4b) of the dynamic damper ~~is/are changed~~ by means of a control device (9) in order to tune the natural frequency of the dynamic damper, ~~characterized in that~~ the vibration induced by rolls (1, 11) which are in nip contact is damped by means of the dynamic damper so that the damper is tuned to a frequency that is substantially equal to a multiple of the rotational frequency of the roll that is closest to the natural frequency of the vibrating system, or to a frequency that substantially corresponds to the problematic excitation frequency of the vibrating system.

2. A method as claimed in claim 1, ~~characterized in that~~, in the method, the vibration frequencies of the vibrating system (2) are measured constantly by means of one or more vibration detectors (6), the measurement signals given by the vibration detector (6) are amplified by means of an amplifier (7) and fed into a vibration analyser (8), which identifies the problematic excitation frequency and converts said problematic excitation frequency into a control signal, which is fed into a control device (9) in order to tune the dynamic damper.

3. A method as claimed in claim 1 ~~or 2~~ wherein the spring of the dynamic damper is a rod (3) attached at one end thereof to the vibrating object, **characterized** in that the spring constant is changed by changing the position of the additional weight (4) on the rod (3).

4. ~~A method as claimed in claim 3,~~ ~~characterized in that~~ when the tuning frequency of the dynamic damper has been made as desired, the additional weight (4) is locked in place on the rod (3) by means of a locking means (30).

5. A method as claimed in claim 4, ~~characterized in that~~ wherein the locking means (30) is operated by means of compressed air.

6. A method as claimed in claim 1 ~~or 2~~, ~~characterized in that~~ wherein a rod (3) made of memory metal is used as the spring of the dynamic damper.

7. A method as claimed in claim 6, ~~characterized in that~~ wherein the natural frequency of the damper is tuned to a correct level by regulating the temperature of the rod made of a memory metal material.

8. ~~A method as claimed in~~ claim 7, ~~characterized in that~~ wherein the temperature of the rod is regulated by means of electric resistors or ~~equivalent heaters~~.

9. An apparatus for damping vibration induced by rolls forming a nip in a paper machine or in a paper finishing device by means of a dynamic damper which comprises an additional weight (4, 4a, 4b) suspended from a vibrating system (2) by means of a spring (3,3a,3b), said apparatus further comprising a control device (9) which is arranged to change the spring constant of the spring (3, 3b) of the dynamic damper and/or the mass (4a, 4b) of the dynamic damper in order to tune the natural frequency of the dynamic damper, ~~characterized in that~~ wherein the apparatus is fitted to dampen the vibration induced by rolls (1,11) forming a nip such that the control device (9) is arranged to tune the damper to a frequency that is substantially equal to a multiple of the rotational frequency of the roll that is closest to the natural frequency of the vibrating system, or to a frequency that substantially corresponds to the problematic excitation frequency of the vibrating system.

10. An apparatus as claimed in claim 9, ~~characterized in that~~ wherein the apparatus comprises one or more vibration detectors (6) which measure(s) the vibration frequencies of the vibrating system (2) constantly and which is/are arranged to transmit a measurement signal, an amplifier (7) that amplifies the measurement signal, a vibration analyser (8) which is arranged to receive the measurement signal transmitted by the vibration detector (6) and amplified by the amplifier (7), to

identify the problematic excitation frequency from said signal and to convert said problematic excitation frequency into a control signal to be fed into the control device (9) in order to tune the dynamic damper.

11. An apparatus as claimed in claim 9 ~~or 10~~, wherein ~~characterized in that~~ the spring (3, 3b) of the dynamic damper is a rod fixed at one end thereof to the vibrating system (2) in a substantially horizontal direction, on support of which rod the additional weight (4,4b) is mounted, and that the control device (9) is arranged to change the spring constant of the spring (3,3b) of the dynamic damper by changing the position of the additional weight (4,4b) on the rod (3,3b).

12. An apparatus as claimed in claim 11, wherein ~~characterized in that~~ a locking means (30) is mounted on the rod (3) serving as ~~the spring~~ of the damper in order to lock the additional weight (4) in place when the tuning frequency of ~~the~~ damper has been made as desired.

13. An apparatus as claimed in claim 11 ~~or 12~~, wherein ~~characterized in that~~ the rod (3) and the additional weight (4) fitted on the rod are provided with matching threads (3'), and that the position of the additional weight (4) on the rod (3) can be regulated by rotating said additional weight on the rod.

14. An apparatus as claimed in claim 13, wherein ~~characterized in that~~ the locking means (30) is arranged to act in the axial direction of the rod (3) and to produce an axial force acting on the additional weight (4) in order to provide a frictional force necessary for locking between the matching threads on the rod (3) and on the additional weight (4).

15. An apparatus as claimed in ~~any one of~~ claims 12 ~~to 14~~, wherein ~~characterized in that~~ the locking means (30) is a piston device fixed onto the rod.

16. An apparatus as claimed in claim 15, wherein ~~characterized in that~~ the piston device (30) is telescopic in order to provide the necessary stroke length.

17. An apparatus as claimed in ~~any one of claims 12 to 16~~, ~~characterized in that~~ the locking means (30) is operated by compressed air.

18. An apparatus as claimed in ~~any one of claims 9 to 17~~, **characterized** in that the additional weight (4a,4b) included in the dynamic damper comprises a container suspended from the spring (3a,3b) and filled with a liquid, the amount of the liquid in said container being adjustable in order to regulate the mass.

19. An apparatus as claimed in claim 18, ~~characterized in that~~ the control device (9) is connected to a pump (21) and to a valve (22) in order to regulate the amount of the liquid.

20. An apparatus as claimed in ~~any one of claims 9 to 19~~, ~~characterized in that~~ the control device (9) comprises a stepping motor ~~or equivalent~~ in order to change the location of the mass of the dynamic damper.

21. An apparatus as claimed in ~~any one of~~ claims 9 ~~to 20~~, ~~characterized in that~~ the apparatus is fitted so as to dampen vibration in a nip in which at least one of the rolls forming the nip is provided with a soft coating (9).

22. An apparatus as claimed in ~~any one of~~ claims 9 ~~to 21~~, ~~characterized in that~~ the dynamic damper and the vibration detectors (6) are fitted and fixed to the bearing housing (2) of the roll.

23. An apparatus as claimed in ~~any one of~~ claims 9, ~~10, 21 or 22~~, ~~characterized in that~~ the spring of the dynamic damper is a rod (3) made of memory metal.

24. An apparatus as claimed in claim 23, ~~characterized in that~~ the natural frequency of the damper is arranged to be tuned by regulating the temperature of the rod made of a memory metal material.

25. An apparatus as claimed in claim 24, ~~characterized in that~~, in order to regulate the temperature of the rod, the apparatus is ~~provided~~ with electric resistors or equivalent heaters.

26. An apparatus as claimed in ~~any one of~~ claims ~~23 to 25~~, ~~characterized in that~~ the additional weight (4) is fixed to the rod (3) rigidly and without a clearance.